

LISTING OF THE CLAIMS:

This listing of claim will replace all prior versions, and listings, of claim in the application:

Claims 1-4 (canceled).

C
Claim 5 (currently amended). A device for injecting bone cement, comprising:

a) a reservoir having an exit opening,

b) an injection chamber having:

i) first and second end portions, and

ii) a sterile inner surface forming an entry opening in the first end portion and an exit opening in the second end portion,

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

c) an impermeable first piston disposed within the inner surface of the injection chamber,

wherein the first and second end portions of the injection chamber define a first axis within the inner surface, wherein the first piston comprises a sidewall having a shape corresponding to the inner surface of the injection chamber, and the first piston is received within the inner surface to allow axial movement of the first piston along the first axis within the inner surface, and

[[The device of claim 2]] wherein the first piston has an inner face facing the exit opening of the injection chamber, the inner face has a centerpoint, and the centerpoint

and exit opening of the injection chamber define a flowpath having an angle of less than 45 degrees [[which is substantially linear]].

Claim 6 (currently amended). The device of claim 5 wherein the flow path has an angle [[of less than 30 degrees]] which is substantially linear.

Claim 7 (currently amended) . A device for injecting bone cement, comprising:

a) a reservoir having an exit opening.

b) an injection chamber having:

i) first and second end portions, and

ii) a sterile inner surface forming an entry opening in the first end portion and an exit opening in the second end portion.

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

c) an impermeable first piston disposed within the inner surface of the injection chamber,

wherein the first and second end portions of the injection chamber define a first axis within the inner surface, wherein the first piston comprises a sidewall having a shape corresponding to the inner surface of the injection chamber, and the first piston is received within the inner surface to allow axial movement of the first piston along the first axis within the inner surface, and

[[The device of claim 2]] further comprising:

d) an O-ring disposed between the sidewall of the first piston and the inner surface of the injection chamber.

Claim 8 (withdrawn).

Claim 9 (currently amended). A device for injecting bone cement, comprising:

- a) a reservoir having an exit opening,
- b) an injection chamber having:
 - i) first and second end portions, and
 - ii) a sterile inner surface forming an entry opening in the first end portion and an exit opening in the second end portion,

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

c) an impermeable first piston disposed within the inner surface of the injection chamber.

wherein the first and second end portions of the injection chamber define a first axis within the inner surface, wherein the first piston comprises a sidewall having a shape corresponding to the inner surface of the injection chamber, and the first piston is received within the inner surface to allow axial movement of the first piston along the first axis within the inner surface, and

[[The device of claim 2]] wherein the first piston has an inner face facing the exit opening of the injection chamber, and the inner face is movable within the inner surface from a first position in the first end portion of the injection chamber to a second position in the second end portion of the injection chamber,

wherein the first position of the first piston allows for fluid communication between the entry and exit openings of the sterile inner surface of the injection chamber, and

wherein the second position of the first piston restricts fluid communication between the entry and exit openings of the sterile inner surface of the injection chamber, and

wherein the first and second positions define a maximum distance over which the first piston is movable along the first axis, and wherein the movement of the inner face from

the first position to the second position defines an inner surface volume of between 0.1 cc and 0.5 cc.

Claims 10-11 (canceled).

Claim 12 (original). The device of claim 9 wherein the entry opening has a diameter, and the first piston sidewall has a length greater than the diameter of the entry opening.

Claim 13 (original). The device of claim 9 wherein the exit openings are in fluid communication when the inner face of the first piston is located in the first end portion.

Claim 14 (original). The device of claim 9 wherein the sidewall of the first piston and the inner surface are in sealing connection, and the inner face of the first piston is movable from the second position to the first position.

Claim 15 (original). The device of claim 9 wherein the second position of the first piston inner face is substantially adjacent to the exit opening.

Claims 16-32 (canceled).

Claim 33 (amended) A device for injecting bone cement, comprising:

- a) a reservoir having an exit opening,
- b) an injection chamber having:
 - i) first and second end portions, and
 - ii) a sterile inner surface forming an entry opening in the first end portion and an exit opening in the second end portion,

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

c) an impermeable first piston disposed within the inner surface of the injection chamber,

[[The device of claim 1 further comprising]]

wherein the first piston operates as a check valve located downstream of the reservoir for sealing the exit opening, the check valve being manually openable and closeable.

Figures 1A-2

Claim 34 (amended) [[The device of claim 1]] A device for injecting bone cement comprising:

a) a reservoir having an exit opening,

b) an injection chamber having:

i) first and second end portions, and

ii) a sterile inner surface forming an entry opening in the first end portion and an exit opening in the second end portion.

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

c) an impermeable first piston disposed within the inner surface of the injection chamber,

wherein the first piston has an inner face, and further comprising:

d) a flow restrictor disposed within the inner surface of the injection chamber between the inner face of the first piston and the exit opening of the injection chamber, the restrictor comprising a slitted sheet normally disposed parallel to the inner face of the first piston,

wherein the slitted sheet comprises flaps formed by slits, wherein said flaps are oriented towards the exit opening of the injection chamber in response to increased pressure from the direction of the first piston, and the flaps return to a position parallel to the inner face upon reduction of the increased pressure, thereby restricting backflow.

Claims 35-39 (canceled).

Claim 40 (amended) A device for injecting bone cement, comprising:

- a) a reservoir having an exit opening,
- b) an injection chamber having:
 - i) first and second end portions, and
 - ii) a sterile inner surface forming an entry opening in the first end portion and an exit opening in the second end portion,

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

wherein the injection chamber inner surface defines a volume of between 0.1 and 0.5 cc [[5 cc]].

Claim 41 (canceled).

Claim 42 (withdrawn)

Claim 43 (withdrawn).

Claim 44 (Original). The device of claim 40 further comprising:

- c) a second piston housed within the reservoir and having an inner face facing the exit opening of the reservoir.

Claim 45 (original). The device of claim 44 wherein the second piston has a sidewall corresponding to the inner surface of the reservoir, and the second piston is slidably received in the inner surface of the reservoir.

Claim 46 (original). The device of claim 45 wherein the shaft has a first end facing the exit opening of the reservoir, the second piston has an outer face, and wherein the first end of the shaft bears against the outer face of the piston.

Claim 47 (currently amended). A device for injecting bone cement, comprising:

- a) a reservoir having an exit opening.
- b) an injection chamber having:
 - i) first and second end portions, and
 - ii) a sterile inner surface forming an entry opening in the first end portion and an exit opening in the second end portion.

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween.

- c) a second piston housed within the reservoir and having an inner face facing the exit opening of the reservoir.

wherein the second piston has a sidewall corresponding to the inner surface of the reservoir, and the second piston is slidably received in the inner surface of the reservoir.

wherein the shaft has a first end facing the exit opening of the reservoir, the second piston has an outer face, and wherein the first end of the shaft bears against the outer face of the piston, and

[[The device of claim 46 further comprising:]]

d) means for locking the second piston to a predetermined location along the reservoir axis, the means for locking comprising an axially retractable, axially fixable shaft.

48 (original). The device of claim 46 wherein the reservoir has an exterior surface, and the fourth opening defines a mating surface on the exterior surface, and wherein the shaft has a mating shank having a corresponding shape for bearing against the mating surface.

49 (original). The device of claim 44 wherein the inner face of the second piston is in substantial sealing connection with the inner surface of the reservoir.

50 (original). The device of claim 44 further comprising a compression spring having a first end, wherein the second piston has an outer face, and the first end of the spring bears against the outer face of the second piston.

51(original). The device of claim 50 wherein the reservoir comprises first and second end portions, the exit opening of the reservoir is disposed in the first end portion of the reservoir, and a fourth opening is disposed in the second end portion of the reservoir, the device further comprising:

d) a shaft axially disposed within the reservoir and slidably received in the backside opening.

52(original). The device of claim 51 wherein the compression spring defines an inner tube, and the shaft is axially disposed within the inner tube of the compression spring.

53(original). The device of claim 52 wherein the shaft has a first end facing the exit opening of the reservoir, the second piston has an outer face, and wherein the first end of the shaft bears against the outer face of the piston.

54(original). The device of claim 44 further comprising:

d)a locking pin comprising a tynce,

wherein the reservoir has a transverse hole for receiving the tynce, the second piston has a sidewall having a recess shaped for receiving the tynce, and the tynce is inserted through the reservoir hole and is received within the recess of the second piston.

Claims 55-58 (withdrawn).

Claim 59 (currently amended). A device comprising:

a) a reservoir having an exit opening,

b) an injection chamber having:

i) first and second end portions, and

ii)a sterile inner surface forming an entry opening disposed at the first end portion and an exit opening disposed at the second end portion,

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

c) [[means for preventing back flow from the exit opening of the injection chamber. and further comprising:]]a flow restrictor disposed within the inner surface of the injection chamber between the inner face of the first piston and the exit opening of the injection chamber, the restrictor comprising a slitted sheet normally disposed parallel to

the inner face of the first piston, wherein the slitted sheet comprises flaps formed by slits, wherein said flaps are oriented towards the exit opening of the injection chamber in response to increased pressure from the direction of the first piston, and the flaps return to a position parallel to the inner face upon reduction of the increased pressure, thereby restricting backflow.

Claim 60 (original). The device of claim 59 wherein the means comprises a check valve located near the exit opening in the injection chamber, the check valve biased in a normally closed position sealing the exit opening of the injection chamber from fluid communication with the entry opening, the valve being openable in response to increased pressure within the injection chamber and recloseable upon reduction of the pressure increase below a predetermined level.

Claim 61 (original). The device of claim 60 wherein the check valve is located in the exit opening of the injection chamber.

Claim 62 (original). The device of claim 60 further comprising:

- d) a first piston disposed in the inner surface of the injection chamber and having an inner face, and
- e) a flow restrictor disposed within the inner surface of the injection chamber between the inner face of the first piston and the exit opening of the injection chamber, the restrictor comprising a slitted sheet normally disposed parallel to the inner face of the first piston, wherein the slitted sheet comprises flaps formed by slits, wherein said flaps are oriented towards the exit opening of the injection chamber in response to increased pressure from the direction of the first piston, and the flaps return to a position parallel to the inner face upon reduction of the increased pressure, thereby restricting backflow.

Claims 63-78 (canceled).

Claim 79 (currently amended). An injection device for injecting bone cement, comprising:

- a) a reservoir having an exit opening,
- b) an injection chamber having:
 - i) first and second end portions, and
 - ii) a sterile inner surface forming an entry opening disposed at the first end portion and an exit opening disposed at the second end portion,

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

- c) means for creating a vacuum in the injection chamber between the entry and exit openings,

d) a check valve located downstream of the reservoir for sealing the exit opening, the check valve being manually openable and closeable, and

e) a flow restrictor disposed within the inner surface of the injection chamber between the inner face of the first piston and the exit opening of the injection chamber, the restrictor comprising a slitted sheet normally disposed parallel to the inner face of the first piston, wherein the slitted sheet comprises flaps formed by slits, wherein said flaps are oriented towards the exit opening of the injection chamber in response to increased pressure from the direction of the first piston, and the flaps return to a position parallel to the inner face upon reduction of the increased pressure, thereby restricting backflow.

Claim 80 (original). The device of claim 79 further comprising:

- d) means for maintaining pressure within the reservoir.

Claim 81 (original). The device of claim 80 wherein the means for creating a vacuum comprises a first piston disposed within the inner surface of the injection chamber.

Claim 82 (original). A device comprising:

- a) a reservoir having an exit opening,
- b) an injection chamber having:
 - i) first and second end portions and
 - ii) a sterile inner surface forming an entry opening disposed at the first end portion and an exit opening disposed at the second end portion,

the exit opening of the reservoir and the entry opening of the sterile inner surface of the injection chamber being in fluid communication therebetween, and

- c) an O-ring contacting the inner surface of the injection chamber.

Claim 83 (original). The device of claim 82 further comprising:

- d) a first piston having a sidewall disposed within the inner surfaces of the injection chamber,

wherein the O-ring is disposed between the sidewall and the inner surface of the injection chamber.

Claim 84 (Canceled).

Claim 85 (withdrawn).

Claim 86(cancelled).

Claims 87-99 (withdrawn).

Claim 100 (original). A method of injecting a bone cement into an interior region of a vertebral body, comprising the steps of:

- a) providing a vertebroplasty injection device having an injection chamber and a reservoir in fluid connection therewith, the injection chamber and the reservoir each containing the bone cement,
- b) fluidly connecting the injection chamber to the interior region of the vertebral body,
- c) discretely injecting a first amount of bone cement from the injection chamber into the interior region of the vertebral body,
- d) flowing bone cement from the reservoir to the injection chamber, and
- e) discretely injecting a second amount of bone cement from the injection chamber into the interior region of the vertebral body.